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P. O. BOX 216 – STATION A
COLUMBUS, OHIO

January 27, 1959

DESTRUCTOR SYSTEMS FILE

Dear Sir:

This letter report summarizes the research performed under Task Order No. Z during October, November, and December, 1958.

During this period, further experimental work, consisting of 9 test runs, was conducted in the experimental refractory-lined incinerator; a new full-scale working model employing an air-film-cooled liner was designed; and a feeding mechanism for paper was designed.

Experimental Work with Refractory-Lined Unit

In all of the tests run since October 1, the gas-offtake grid has prevented the escape of fly ash and unburned paper in the legible size range above 3/16 inch. Therefore, a similar grid was included in the design of the new unit, discussed later.

In all but two of the 34 test runs conducted to date in the experimental unit, obsolete telephone books were burned as a standard charge material. The books were torn along the binding into about six equally thick sections, with many loose sheets. To check the effect of using other kinds of paper as the charge material, two tests runs were made by burning a typical assortment of letter papers, folders, and small bound reports which were obtained from our outdated files. During these two test runs, the flow rate of

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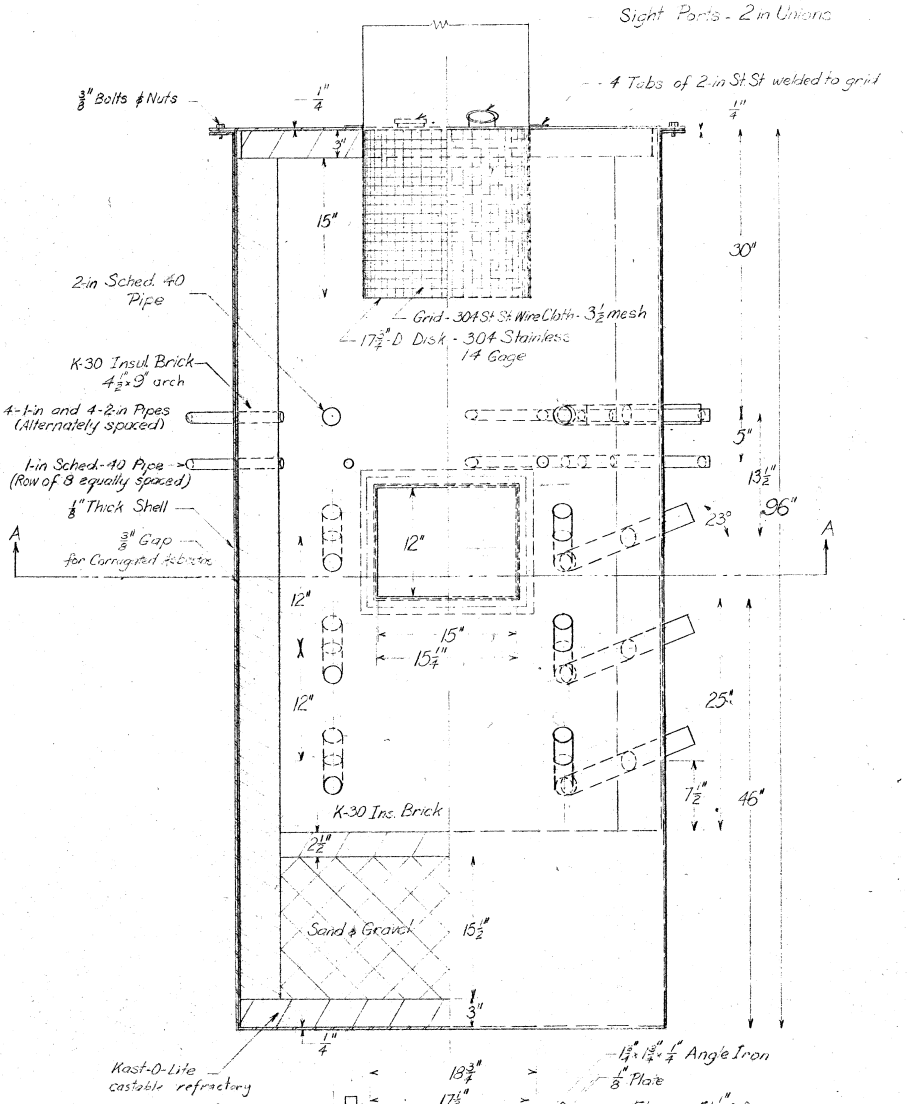
primary air was adjusted frequently to maintain high, but not excessive flue-gas temperatures of from 1000 to 1500 F, in order to obtain maximum sustained burning rates between batch loadings. Average burning rates of 500 and 520 lb per hr were obtained in these tests. It is to be noted that the second of these two tests was run during your visit on October 15.

Although average burning rates of 500 lb per hr have been demonstrated frequently, at these rates of operation there have been periods during which excessive smoke and flames have been emitted from the stack. To minimize or prevent these occurrences, further development was aimed at better mixing of the gases above the burning paper through the use of increased flow of secondary air and additional air-entry ports.

Figure 1 is a drawing of the experimental refractory-lined incinerator with 12 new horizontal secondary-air ports installed to direct air tangent to a 21-inch-diameter circle. These ports, together with the original four larger horizontal ports, provided for increases of secondary-air flow up to 75 per cent above that used in previous tests, and increased the total flow of air required by up to 40 per cent. Subsequent tests showed that the emission of smoke was almost completely eliminated by this increase in secondary air. The frequency of occurrence and duration of flame emission were likewise reduced, but not to the degree desired at maximum burning rates. However, at lower burning rates of about 200 lb per hr, smoke and flames were completely eliminated.

FIG. 1 CYCLONE JET INCINERATOR

SCALE DRAWING 1/3-in = 1-in



DRAWN BY: P.G.
CHECKED BY: G.M.H.
DATE - 12-16-1958

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In an effort to reduce further the emission of flames to durations of less than a total of 1 to 2 minutes per hour of operation, air was supplied to the central core of the burning chamber by an axial duct (3 inches in diameter) installed at the bottom of the incinerator. Three tests were made with the unit so modified. The first was run with one 1.5-inch-diameter jet of air directed upward from a level 28 inches above the bottom of the chamber; the second, with 36 jets, each 1/4 inch in diameter, directed radially outward and located along the axial duct up to a height of 15 inches above the bottom of the chamber; and the third, with increased air flow obtained by enlarging some of the 36 jets to 3/8- and 1/2-inch diameter. In these tests, the emission of flames was not decreased sufficiently to warrant the inclusion of a central duct in the subsequent design, particularly since there would be attendant disadvantages such as interference during loading of the paper charges.

At the close of the currently planned experimental work with the refractory-lined incinerator, in mid-November, many of the factors bearing on the design of an air-film-cooled unit were resolved, and the design of the new unit was begun.

Design of Air-Film-Cooled Incinerator

The initial drawings of the new unit were reviewed with you during our meeting on November 25. We indicated that the over-all height of the unit would be reduced by several inches, to 64 inches, and also that the idea of trying radially directed air ports in a second experimental liner would be shelved.

Revised drawings (D-5901-A and C-5902-A) incorporating these changes were mailed to you on December 5. These were discussed and approved at our meeting on December 15. A sketch of the loading door was also discussed with you at that time.

To check for proper angular placement of the main tangential air ports (see your copy of Drawing C-5902-A), a quadrant section of the liner and outer shell was fabricated, and flow tests were conducted with it near the end of December. The results showed that the main jets of air from a short oblique nozzle gave the desired direction and spread of air under simulated conditions of air velocity in the annular plenum chamber.

Construction of the air-film-cooled incinerator will begin early in January. It is expected that assembly will be completed near the end of January.

Design of Paper-Feeding Mechanism

In the meeting with you on December 15, we discussed the requirements of the feeding mechanism and the ideas we had evolved. The basic requirements which were agreed upon were as follows:

(1) A batch process appears more desirable than continuous feed.

(2) The mechanism should be capable of feeding papers at a rate sufficient to dispose of 500 lb per hr.

(3) There should be a curved inner door to prevent flames and burning paper from entering the annulus and loading area.

(4) The loading hopper should be large enough to take 8-1/2" x 11" paper in any position and legal-size paper in one position.

(5) The mechanism should be easily operated by hand or foot.

(6) The mechanism should occupy a small space.

(7) The mechanism should be readily detachable for maintenance.

(8) The loading area should not get hot.

We discussed approximately 17 ideas which had evolved from our idea meetings and selected a sliding-box design for further development. This design consists essentially of a box which is open at the top and bottom, and is guided by side rods in a stationary box, which is open at the ends, and into the burning chamber. The end of the stationary box which opens into the incinerator is sealed by a curved door which moves in when the movable box is pushed forward and returns to seal the opening when the movable box is pulled out. The unit has been designed to permit easy modification or addition of other features such as outer doors, seals, and rollers, should they be found necessary after preliminary tests are conducted.

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The layout and detail drawings of this experimental unit were completed in December and the necessary material ordered. Fabrication of the unit will start the first week of January and is expected to be ready for preliminary testing during the last week of January.

The total appropriation on this Task Order was $59,470. As of January 1, 1959, the unexpended balance was approximately $28,300.

Sincerely,

A. B. Westerman

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In Duplicate

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